

## ABSTRACT

A semi-insulating zinc-oxide (ZnO) single crystal. The crystal has resistivity of at least  $1.5 \times 10^3$  ohm-centimeter ( $\Omega\text{-cm}$ ). The ZnO crystal can be produced from a melt contained by solid-phase ZnO to prevent introduction of undesired impurities into the crystal. The crystal can be a bulk single crystal that is cut and processed into wafer form of specified thickness. A dopant in a concentration ranging from  $1 \times 10^{15}$  atoms per cubic centimeter (atoms/cc) to  $5 \times 10^{21}$  atoms/cc can increase resistivity of the crystal relative to intrinsic ZnO. The dopant can be lithium (Li), sodium (Na), copper (Cu), nitrogen (N), phosphorus (P), and/or manganese (Mn).